III. "On the Shoulder Girdle in Ichthyosauria and Sauropterygia." By J. W. HULKE, F.R.S. Received April 11, 1892.

(Abstract.)

The author discusses the structure of the shoulder girdle and the homologies of its several parts in these families. He shows that the alleged existence of a precoracoid in the Ichthyosauria rests on an insufficient foundation; offers proofs that in Plesiosauria the anterior ventral ray is not only theoretically but *actually* precoracoid; and also that the dorsal ray in the girdle *is* homologous with the shoulder-blade in Testudinata and other Reptilia.

IV. "On the Embryology of *Angiopteris evecta*, Hofm." By J. BRETLAND FARMER, M.A., Fellow of Magdalen College, Oxford. Communicated by S. H. VINES, M.A., F.R.S. Received March 28, 1892.

During a recent visit to Ceylon I took the opportunity of collecting young plants and prothallia of *Angiopteris evecta*, with the view of working out the embryology of this type of the eusporangiate Filicineæ, since the development of the embryo is not as yet known in any member of this group.

Most of my specimens were obtained from clay banks in the vicinity of Peradeniya, where the plants are not uncommon. The prothallia are easily distinguished from those of other Ferns by their somewhat orbicular shape, with crenate edges, as well by their strikingly deep-green colour. They resemble the thalli of *Anthoceros* rather than a common Polypodiaceous prothallium, and indeed are not easily distinguished from the former when the two plants are associated on the same bank, as is frequently the case.

The germination of the spore and the development of the prothallium have been described by Jonkman,* who also observed the formation of the sexual organs. The antheridium is formed from a superficial cell of the prothallium, which divides by a wall, parallel to the surface, into an outer shallow cell and an inner cubical cell. The former, by walls at right angles to the free surface, gives rise to the cover cells; while the inner one, by successive bipartitions, originates the antherozoid mother-cells. This Fern is a very favourable type for exhibiting the development of the antherozoids from the nucleus of the spermatocyte, on account of the relatively large size of the structures in question.

* 'De geslachtsgeneratie der Marattiaceeën,' door H. F. Jonkman.

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The antheridia are distributed both on the upper and lower surfaces of the prothallium, and apparently without any approach to regularity, though they are somewhat more frequent on the lower surface. I may observe, however, that an antheridium may often occur on the upper surface immediately above an archegonium which has been fertilised.

The archegonia occur exclusively on the lower surface. Their development has been described by Jonkman, who also noticed the division of the neck canal cell, by a transverse wall, into two cells. The division is not, however, invariable, and in one preparation in which the protoplasm had shrunk slightly from the wall, I observed that the cell plate had not extended so as to completely partition the neck passage into two cells.

The neck canal, and ventral canal, cells become converted into mucilage, which bursts open the archegonium, and thus admits of the passage of the antherozoid to the oosphere.

The oospore, after fertilisation, speedily forms an ovoid cellular body, and although I was not so fortunate, owing to scarcity of material, as to see the formation of the earliest cell walls, their succession could be determined with tolerable certainty in the youngest embryo that I met with, consisting as it did of about ten cells.

The basal wall is formed, as in *Isoëtes*, at right angles to the axis of the archegonium. The next one in order of occurrence I believe to be the median wall, which can easily be distinguished, even in advanced embryos, as a well-defined vertical line.

The transverse wall is much more indefinite, and early loses its individuality owing to the unequal growth of the various parts of the young embryo. The further cell-division is irregular, and to a far greater extent than is the case with the leptosporangiate Ferns as described by Hofmeister and Leitgeb. I was unable to determine the constant occurrence of segment walls, though indications of them could occasionally be seen in a few preparations.

The anterior epibasal octants together give rise to the cotyledon; the stem-apex is formed, not as in the leptosporangiate Ferns, from *one* octant only, but from *both* of the posterior epibasal octants, though one of them contributes the greater portion. The truth of this statement is seen on examining vertical sections through the embryo cut at right angles to the median wall, when a few cells on each side are seen to be clearly marked out by their dense protoplasmic contents and large nuclei, as meristem cells. There is no single apical cell in *Angiopteris* from which all the later stem tissue is derived, and this fact is, without doubt, to be connected with the character of the apical meristem just described. The root is formed from one of the octants beneath the cotyledon, *i.e.*, from an anterior hypobasal one, and is at first indicated by a triangular apical cell,

which, in one fortunate preparation, showed the first cap cell. The other octant, together with the two posterior hypobasal octants (which together form the rudimentary foot), round off the base of the embryo. The root presents considerable difficulty in tracing the course of its development, as the apical cell, at no time very clear, is early replaced by two cells, as I convinced myself by an examination of sections specially cut obliquely in order to determine this point. Moreover, the root grows in a somewhat sinuous manner in the embryo, and the cells of its apex may easily be confounded with other triangular cells which occur irregularly scattered in the lower portion of the embryo. It finally emerges, not immediately beneath, nor yet exactly opposite, the cotyledon, but at a distance from it of between one-third and one-half of the circumference of the embryo. The difficulties attending the exact following of its growth, added to the scarcity of the material, have prevented my elucidating completely the details of development, but the important point, that, even before its emergence from the embryo, its apex contains a *group* of initial cells occupying the place of the single one characteristic of other orders of Ferns, can be regarded as established with certainty.

The vascular strand, which is differentiated early in the cotyledon, joins on to that of the root, and the first tracheid appears in that part of the bundle which is opposite to the junction of the cotyledon with the stem, in fact, just at the point where the leaf-trace curves round into the latter. Thence the further differentiation of the xylem takes place in an upward and downward direction.

When the embryo has reached a certain size it bursts through the prothallium, the root boring through below, whilst the cotyledon and stem grow through the upper surface. This manner of issuing from the prothallium at once serves to distinguish *Angiopteris* from those other Ferns whose embryogeny is known, and probably the peculiarity of its growth may be reasonably connected with the direction and position of the basal wall which separates the root and short portions of the embryo. It will be remembered that in this plant the basal wall is parallel to the plane of the prothallium, instead of nearly at right angles to it, as in the leptosporangiate Ferns.

Fresh leaves and roots speedily arise on the young plantlet, the second leaf appearing just above the place of exit of the first root, that is, not quite opposite the first leaf. The third leaf rises between the first and second ones, and nearer the first than the second. Their roots observe the same rule of divergence as that which obtains in the case of the first root. The stipular structures, so characteristic of the Marattiaceæ, are entirely absent from the first two leaves, but appear in a well-developed condition on the third and all succeeding leaves. They fulfil the function of enclos-

ing and protecting the younger foliar structures, from the time of their first formation.

V. "Note on Excretion in Sponges." By GEORGE BIDDER. Communicated by ADAM SEDGWICK, F.R.S. Received April 9, 1892.

In a review* of Mr. Dendy's work on the Homocœla, I briefly described (p. 628) the "flask-shaped" or "glandular" epithelium, which I believe to form the most common external covering in all groups of sponges. On p. 631 are shortly mentioned certain other granular cells, believed by Metschnikoff to be mesodermal, and by Dendy to be the dwelling place of symbiotic Algæ; I proposed the neutral name of "Metschnikoff cells." "In *Ascetta clathrus* there is an additional point of interest, that the granules in the (glandular) ectoderm cells differ from these," *i.e.*, the granules in the Metschnikoff cells, "only in being of smaller size. I have been very slowly and gradually led to the conclusion that the bodies in question, which I propose to call 'Metschnikoff cells,' are metamorphosed collar cells; that by their reaching to the exterior and becoming perforated, pores are formed; and that the granules of these and of the ectoderm, and of the glandular ectoderm in general (and possibly the granular cells so frequently described beneath it in Silicea), are excretory."

This latter proposition, so far as concerns *Ascetta*, may now be considered proved, and I think the observation sufficiently important to justify my asking permission to communicate it to the Society. Leaving a sponge in a solution of indigo-carmine in sea-water (at first I used a saturated, but afterwards a weaker, solution), I found that the granules normally present in the Metschnikoff and ectoderm cells become replaced in part by dark-blue granules, no other part of the sponge being in any way coloured blue. Fig. 1 shows a Metschnikoff cell from a specimen of *Ascetta clathrus*, which had been thirteen hours in saturated indigo-carmine solution. The black dots represent the granules which were blue, the colourless circles those which were of the usual yellow; a few of intermediate shading represent granules which appeared pale-blue or green. Focussing showed that, while this cell stretched under the spicule into the deep parts of the sponge wall, the left-hand extremity emerged on the upper (ectodermal) surface.

This particular cell I had the pleasure of demonstrating, while

* 'Quart. Jl. Micr. Sci.,' Oct., 1891, *Review*—Subsequently reprinted, by the permission of Messrs. Churchill, under the title of 'Notes on Calcareous Sponges.'